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Does Sex Matter? Ageing and Ability to Conceive

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Abstract

Recently there has been increasing interest in the estimation of age-specific fecundability as a result of the progressive postponement of age at family formation in Western countries. It must be noted, however, that the possible negative effects of the postponement could act not only on the physiological component of the ability to conceive but also on the behavioural component (i.e., sexual activity). The main aim of our study was to verify if, the desire to have a child being equal, the coital frequency decreases in one's 30s as compared to the 20s. For our analysis we used the data from the *Multinational Study in Daily Fecundability* (MSDF), which has produced a very rich database with behavioural and physiological information prospectively collected on every cycle. We found empirical evidence that the desire to have a child only partially compensates for the decline of coital frequency with age.

1 Introduction

The estimation of age-specific fecundability (i.e., the probability of conception in the menstrual cycle for a sexually active non-contraceptive couple, Gini 1923) has been a subject of research for quite some time now. Recently there has been increasing interest in this topic as a result of the progressive postponement of age at family formation in Western countries.

In order to correctly estimate the effect of biological ageing on fecundability it is important to collect detailed information through a rigorous study design, and to apply suitable models for analysing time to pregnancy data (Rizzi et al. 2005). Specifically, it is widely recognised in the literature that in order to study the association between age and fertility it is crucial to "adequately adjust for sexual

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behaviour" (Dunson et al. 2002). Since frequency of acts of intercourse tends to decrease with age, any analysis which fails to take this change into account "would yield an apparent, but artefactual, decline in fecundability with age" (Weinstein et al. 1993).

It must be noted, however, that the possible negative effects of the postponement do not only act on the biological component of the ability to conceive.

Recently, by using a longitudinal study with information on intercourse collected daily through each menstrual cycle, McDonald et al. (2005) found that fecundability in the early 30s is not significantly lower as compared to fecundability in the late 20s: with the postponement of conception of the first child from age 28 to age 33, the mean waiting time increases only by one cycle.

Such an approach is appropriate if the aim is to measure the impact of biological ageing on fecundability. However, it is not in itself enough to draw conclusions on the consequences of the postponement of entry into parenthood on the capability to obtain the desired family size—unless the implicit assumption that the desire to have a child counterbalances the general tendency of a decrease in the coital frequency with age proves to be true. Is such an assumption tenable? And tenable to what extent?

In other words, can we assume that the desire to achieve a pregnancy would lead a couple in their 30s to engage in the same sexual behaviour they would have shown during their 20s? For example, the fact that the biological capability to conceive does not substantially vary between age 28 and 32 can lead to the conclusion that the postponement from 28 to 32 years of age does not have any remarkable impact on the timing and capability of achieving a first pregnancy, but only on the condition that the coital pattern remains equal. If this were not the case, the negative consequences of postponement would act not only on the physiological component but also on the behavioural component of the ability to conceive.

In this study we would like to empirically verify two hypotheses. The first is that, the desire to have a child being equal, the coital frequency decreases in one's 30s. The second is that such a decrease mainly acts on the male component of the couple. We rely on the data from the *Multinational Study in Daily Fecundability* (MSDF), which has produced a very rich database with detailed behavioural and physiological information prospectively collected on every cycle.

2 Background

The decline of coitions during the life course has been observed among couples residing in different countries, in both developed and developing areas of the world (Udry et al. 1982; Leridon 1996; Brewis and Meyers 2004[1]; Rizzi 2005)[2].

A key issue, when studying the decline of coitions during the life course, is the disentanglement of the relative contribution of the male and female partner. Some authors affirm that male sexuality increases until the 20s and then declines (Kinsey et al. 1953, Pearl 1925, cited in Udry and Morris 1978). According to Kinsey and colleagues this trend would depend principally on physical impairment (concerning: sexual responsiveness, morning erection, speed in erection, its duration and angle, precoital mucus secreted, repeated climax, etc.). In James (1974), too, an important effect for male age appears, while controlling for female age. Even more recently, using a cross-sectional survey, Brewis and Meyer (2004) show that, in most of the countries considered for their study, coital frequency declines with the male partner's age, while controlling for the woman's age.

In contrast with these findings, Udry and Morris (1978) state that during the reproductive years a declining frequency of acts of intercourse is related to the age of the woman, while only during the older years it is associated with the age of the husband. In their analysis they try to prove that decline in sexuality with the woman's age depends on interrelated biological and social factors where biological causes are not hormonal ones.

More generally, Udry and Morris (1978) object to the common view in the scientific literature about a declining *capacity* for sexual activity: "The reason is that for the vast bulk of the population actual frequency never approaches physical capacity. (...) In the Kinsey data, half the couples in which the husbands are age 26 to 30 had intercourse less than twice a week and half the couples in which husbands are age 46 to 50 had intercourse less than once a week. Surely no one believes that this is the measure of physical capacity for males of these ages, not to mention females".

The same position is taken by Call et al. (1995). They affirm that the most recurrent explanations for sexual activity diminishing with age refer to biological factors: "This explanation includes declines in male motivation and physical ability, declines in women's testosterone levels, and increases in illness". But the same authors add: "Although biological and physiological factors associated with ageing are involved, they do not explain why acts of intercourse frequency begins

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1 See also Brewis and Meyer (2004) for references on studies on US samples.

2 According to Udry and Morris (1978) a secular trend might be also present when the new models of "sexual socialisation" are less effective on older generations than on younger ones, who are more sexually motivated. This phenomenon engenders a cohort effect, appearing as an age effect. To measure a real age effect longitudinal data should be used instead of cross-sectional data.

to decline well before the final decades of life. For example, these factors are hardly sufficient to explain the rapid drop in the frequency of marital sex that occurs shortly after marriage". Therefore, in order to correctly measure the effect of age on sexuality, one has to control for duration of marriage. Several researchers report that the frequency of intercourse episodes declines with marital duration, net of the age effect (Brewis and Meyer 2004; Leridon 1996; Call et al. 1995; Greenblat 1983). Some authors hypothesise that the frequency of marital sex decreases because the satisfaction with marital sex declines with marital duration (Liu 2003). Call et al. (1995) refer to the concept of "habituation", i.e., there is a decrease in interest because of the increased accessibility to a sexual partner and the predictability in sexual behaviour with that partner over time.

Finally, the age effect on sexuality could also partially depend on changing fertility intentions by age, as younger couples more probably desire a pregnancy and, consequently, they try to have a higher number of episodes of intercourse per cycle. To our knowledge, in previous studies, intentions have been rarely controlled for.

3 Data

A Multinational Study on Daily Fecundability—MSDF—was conducted, concerning 1,074 couples and 10,508 menstrual cycles, for which 752 pregnancies were detected. The couples involved must not have had any evident sign of sterility. They had expertise in Natural Family Planning (NFP) methods, as they were recruited from NFP centres. In total, eleven European centres were involved, plus one centre from Auckland (Colombo and Masarotto 2000; Colombo et al. 2006).[3] At the entry into the study, women were asked about their own age and partner's age, time of marriage and previous pregnancies. For further details on other information collected at entrance, see Colombo and Masarotto (2000).

During the study, women daily recorded all the relevant information concerning their cycles in order to indirectly determine the ovulation-day by mucus quality and/or basal body temperature. Moreover, to estimate daily fecundability, investigators established that also intercourse had to be recorded daily. It was strictly required of couples not to use any contraceptive devices. The couples who had protected intercourse were dropped from the analysis.

Detailed prospective information on acts of intercourse is one of the most important feature of MSDF data. It is well known that recorded data on

[3] The eight centres using the Symptom-Thermal method were located in the following cities (in brackets the number of couples recruited): Verona (214), Milan (272), Lugano (13), Paris (104), Dusseldorf (105), London (45), Bruxelles (29) and Auckland (99). The four centres specialized in the Billings method were all from the North-Centre of Italy: Milan (50), Parma (98), Saluzzo (17), Roma (28).

intercourse have to be preferred to reported data (James 1981; Udry 1993). According to Udry, "when the exact placement of each coital episode on a particular day or time of day is important, there is no substitute for daily reporting" as retrospective reports covering even only a week are highly unreliable for establishing a pattern of intercourse. Moreover, our recorded data are supposed to be of good quality for several reasons: the clinical context of the study; the feeling of trust between women and their instructors of NFP methods; the simultaneous daily recording of other information on the biology of the cycle, needed in order to identify a marker of ovulation.

4 Methods

In the MSDF the timing of the acts of intercourse in the cycle is known and the timing of an ovulation marker is also identified for the most cycles. Consequently, information on the distance in time between a single act of intercourse and the ovulation marker is available. On the basis of previous analyses (Colombo and Masarotto 2000), the fertile window of six days (-4,+1) is taken as the most fertile period of the cycle[4]. Cycles having at least one intercourse episode in this window are considered at high risk of conception, and, consequently, couples knowing NFP methods are very probably seeking to have a pregnancy. Given the importance of the timing of intercourse with respect to the ovulation marker, only those cycles for which indirect identification of ovulation was possible (by mucus quality information) were retained in this study.

Once cycles at risk of conception have been identified, a more precise and conservative criterion to establish which couples are "avoiders" and which couples are "achievers" is needed. In the MSDF couples weren't asked about their procreative intention at the beginning of each cycle. Since couples are expertised in NFP, we can assume that a behaviour directed to avoid or achieve a pregnancy is consistent with the couple's procreative intentions: couples would try to have intercourse around ovulation to achieve a pregnancy, or have intercourse far from ovulation if trying to avoid conception.

When all the cycles observed for a couple are not at risk of conception, i.e., no episodes of intercourse was registered in the (-4,+1) fertile window, it is assumed that the couple is trying to avoid conceiving—a total of 429 couples are identified as "avoiders". On the contrary, if all cycles observed are at risk, i.e., at least one intercourse is registered in the (-4,+1) fertile window, it is assumed that the couple is trying to achieve a conception—a total of 330 couples are identified as "achievers". Couples with an in-between behaviour are classified in a third group (278 couples, they typically are achievers that in at least one cycle did not have

[4] "0" indicates the day of ovulation in the cycle. The most fertile window (-4,+1) includes four days before ovulation, day of ovulation and one day after.

intercourse in the fertile window, or avoiders that have engaged in risky behaviour in at least one observed cycle).

Furthermore, we decided to limit our study to only the first six cycles per couple. This is because a couple's procreative behaviour may change during the study: some couples may have tried to achieve a pregnancy and after several negative attempts they may have changed their mind. On the other hand, some couples may have tried to avoid pregnancy at the beginning but later may have tried to achieve it. In total we selected for this study 1,037 couples and 3,757 cycles.

The distribution per number of observed cycles is shown in Table 1. It must be noted that most of the avoiding couples has at least six observed cycles, while most of the achieving couples are observed for one cycle (as soon as they are successfully pregnant, they are no longer part of the observed sample).

Table 1:
Distribution per number of observed cycles. All couples, and couples classified as Avoiders and Achievers (*)

	All couples		Avoiders		Achievers	
No. of observed cycles	No. of couples	% of couples	No. of couples	% of couples	No. of couples	% of couples
1	200	19.3	62	14.5	138	41.8
2	156	15.1	56	13.0	62	18.8
3	134	12.9	42	9.8	49	14.8
4	134	12.9	48	11.2	30	9.1
5	171	16.5	81	18.9	25	7.6
6	242	23.3	140	32.6	26	7.9
Total	1,037	100.0	429	100.0	330	100.0

(*) Up to six cycles.

5 Results

We start with a descriptive analysis on the relationship between male and female age and coital frequency, separately for achievers and avoiders. In this first phase we consider only the first observed cycle for every couple (Figures 1 and 2). As expected, achievers show an average number of acts of intercourse (in the whole cycle) that is remarkably higher (almost double) than the number registered for the group of avoiders. Furthermore, even for achievers we can observe a strong decrease in sexual activity with age. In other terms, our preliminary results seem to support the hypothesis that the general decline of coital frequency by age occurs almost independently of the desire to have a child.

Figure 1:
Average number of acts of intercourse (in the whole cycle) by age. Avoiding couples

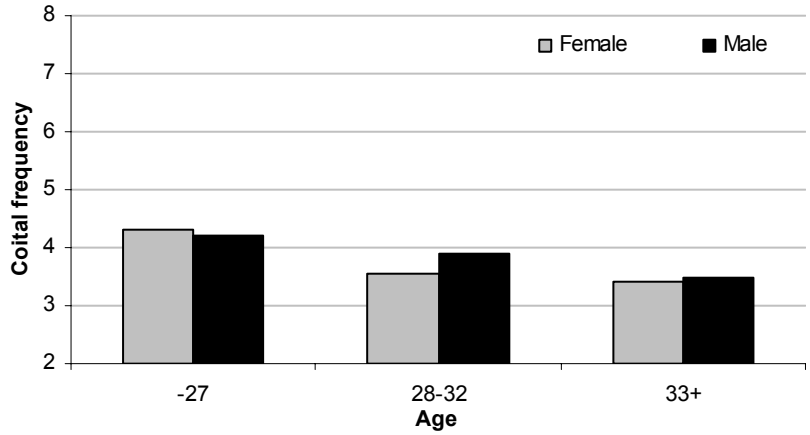
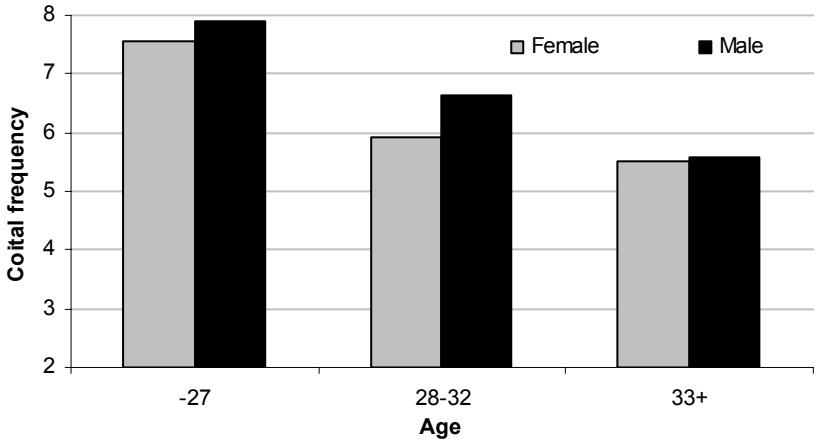


Figure 2:
Average number of acts of intercourse (in the whole cycle) by age. Achieving couples



To go into further depth, a Generalised Linear Model for longitudinal data is applied. More specifically we use a Poisson model with log-linear link. The main aim is to estimate the distinct effect of male age and female age on sexual activity, net of the duration of marriage. We typically have various cycles for each couple and we account for the correlation within the couple by using the Generalised estimating equation approach (Diggle et al. 1994).

The dependent variable is the coital frequency in the whole cycle. The covariates included in the model are[5]: being achiever or avoider, the age of the woman, the age of the man, the duration of marriage, the specific centre that collected the data.

From the model we obtain a general negative effect of age, with the female age effect prevailing (Table 2). Moreover, the interaction between being an achiever and age is not significant. This means that the negative effect of age has the same magnitude for both achievers and avoiders. This provides empirical evidence for the hypothesis that the desire to have a child doesn't compensate for the general decline in coital frequency by age.

The fact that the effect of the woman's age is stronger than that of the man is on the other hand in contrast with our second hypothesis, which states that the decline mainly acts on the male component of the couple (as reported in most of the relevant literature).

Figure 3 provides a visual representation of the strong decline of the sexual activity from the 20s to the early 30s for both avoiders and achievers[6].

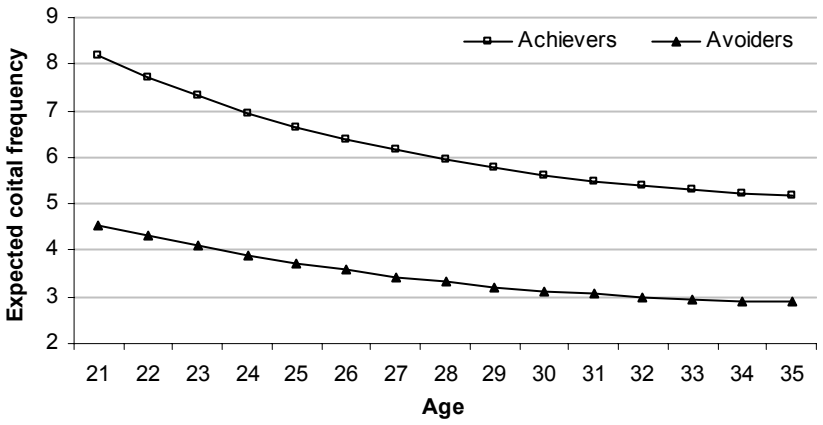
Table 2:
Analysis of the coital frequency (in the whole cycle) using a log-linear regression model for longitudinal data (Model 1)

Variable	Estimate	p-value
Intercept	3.461	<0.001
Intentions		
Avoiders (ref.)	-	-
Achievers	0.911	0.003
Age		
Female age	-0.082	0.008
Male age	-0.048	0.083
Female age*Male age	0.002	0.055
Achievers*Female age	-0.012	0.274
Duration of marriage		
0-2 yrs	0.235	<0.001
3-5 yrs	-0.004	0.942
6+ yrs (ref)	-	-
Missing	0.043	0.522

5 By considering the covariates two by two the highest correlation is between male and female age, and it is equal to 0.49.

6 We plotted the estimated coital frequency obtained from the model, setting the male age = female age + 3 (where 3 is the average difference between the partners' age) and considering the category of reference for the other covariates.

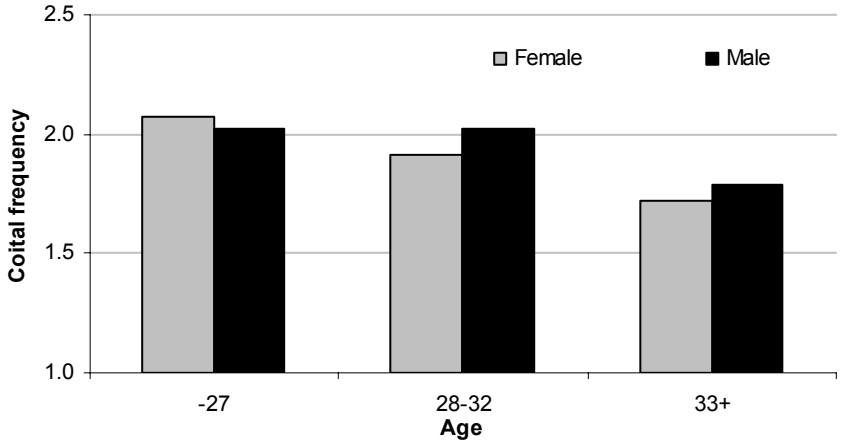
Figure 3:
Number of expected acts of intercourse by female age, according to the results obtained from Model 1 (Table 2)



Until now, we have analysed the coital frequency over the whole cycle. However, what is most important for achievers (in order to fulfil their procreative goal) is their sexual activity during the fertile days of the cycle. Therefore, we decided to limit the analysis to the acts of intercourse in the most fertile window, i.e., in days (-4,+1).

From a descriptive analysis, we can observe that the decreasing trend of frequency of acts of intercourse by age is observed also in the most fertile days (Figure 4).

Figure 4:
Average number of acts of intercourse in window (–4,+1) by age



This result is confirmed by a second log-linear regression model for longitudinal data. The covariates are exactly the same as the ones used in Model 1. The only difference to the previous model is that now the dependent variable is the coital frequency in the fertile window (-4,+1). We obtain a significant negative effect of female age on sexual activity. This provides empirical evidence that even the sexual activity of achievers declines in the days near ovulation with age.

We wonder if the decline in the most fertile window is less pronounced than the decline observed in the whole cycle (meaning that achievers become more efficient with age, concentrating their sexual energy around the ovulation period). In order to answer this question a third model is applied. In this last model we use the same covariates that we already used in the previous models, but the dependent variable is now the proportion of acts of intercourse in the most fertile window out of the total number of acts in the cycle. Since the dependent variable is now a proportion, for this last model we adopt a Binomial distribution and a logit link.

The results are shown in Table 3. Here too the female age prevails and its effect is positive. This gives empirical support to the idea that with ageing, achievers tend to become more efficient by concentrating their sexual activity in the most fertile days of the cycle. This also means that for achievers the observed decline of the coital frequency with age mainly refers to the days outside the most fertile window.

Summarising, Model 1 tells us that even for achievers the number of acts of intercourse significantly decreases with age, Model 2 that the decline is significant in the most fertile days as well, and Model 3 that ageing achievers tend to become more efficient, intensifying their relative number of acts of intercourse near ovulation. These results indicate that for achievers the decline of coital frequency with age, although inferior in the most fertile window when compared to the rest of the cycle, is nonetheless significant.

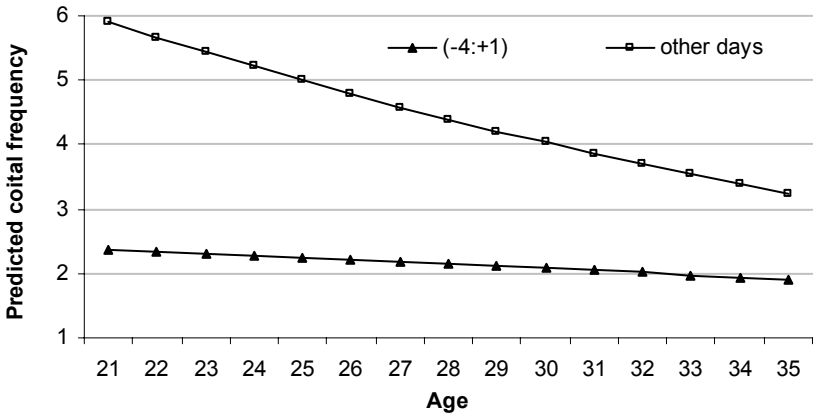
Figure 5 provides a visual representation of the distinctive female age pattern for achievers in the most fertile window and in the rest of the cycle. The graph is obtained by combining the proportion of acts of intercourse in days (–4,+1), predicted by from Model 3[7], with the number of acts of intercourse in the whole cycle, predicted from Model 1.

[7] With only the main effects.

Table 3:
Analysis of the proportion of the coital frequency in the window (-4,+1) using a logistic regression model for longitudinal data (Model 3)

Variable	Estimate	p-value
Intercept	-1.378	0.003
Age		
female age	0.034	0.016
male age	-0.010	0.541
Duration of marriage		
0-2 yrs	-0.179	0.286
3-5 yrs	0.141	0.354
6+ yrs (ref.)	-	-
Missing	0.007	0.961

Figure 5:
Predicted coital frequency by female age (from Model 1 and Model 3) in the most fertile days and in the rest of the cycle (achieving couples)



6 Discussion

The main aim of our study was to verify if, the desire to have a child being equal, coital frequency decreases in one's 30s as compared to the 20s. There is a lack of results in the scientific literature about this point, due to the difficulties of obtaining suitable data. In fact, most of the studies are based on cross-sectional surveys and/or are unable to distinguish between couples who desire a pregnancy and those who do not.

For our analysis we used the data from the *Multinational Study in Daily Fecundability* (MSDF) which has produced a very rich database with detailed behavioural and physiological information prospectively collected on every cycle.

In the MSDF couples were not asked about their procreative intention at the beginning of each cycle. Since couples were skilled in NFP we assumed the couples' intention to be consistent with their coital behaviour: they would try to have intercourse around ovulation if desiring to have a child or they would have intercourse far from ovulation if trying to avoid conception. Although the strategy adopted to identify "avoiders" and "achievers" can be considered reasonable, other choices could have been made. Nevertheless, we can hardly dismiss the idea that (especially for couples expertised in NFP) episodes of intercourse systematically concentrated within the fertile window are a sign of the couple's intention to become pregnant, and that episodes of intercourse systematically outside that window are a sign of the intention to avoid pregnancy. Yet, it would be useful for future research to have detailed information on the physiology and on the behaviour, such as the data provided by MSDF, with additional information on the declared intention as well.

Another possible limit of our study is that the couples who seek advice from NFP centres are not necessarily representative for the whole population. However, we do not have any reason to assume that the relationship between sexual activity and age is different for this sub-population rather than in the rest of the population.

Our findings are consistent with the hypothesis that a desire to have a child only partially compensates for the decline in coital frequency with age. In fact, the coital frequency of the achievers significantly declines from the 20s to early the 30s in the most fertile window too, although to a lesser extent when compared to the general decline with age. This means that the progressive postponement of family formation in Western countries may have a negative effect on the ability to conceive, not only because the biological component (fecundability) declines with age but also because the behavioural component (sexual activity) significantly decreases as well.

McDonald et al. (2005) in their analysis show that a variation in coital frequency during the most fertile days has a substantial impact on the waiting time to conception. In future research it might be interesting to specifically quantify the impact of the decline in coital frequency by age estimated in the present study.

Our second hypothesis, which is in accordance with most of the results presented in the literature, anticipated a stronger age effect for men than for women. On the contrary, however, the effect of female age prevails in all our models. A possible explanation would be that in our study the duration of marriage is better controlled for than in most studies in the literature. This covariate could "absorb" the most relevant part of the reduction of the desire, mainly as a consequence of the habituation effect within couples. A second

possible explanation would be that from a man's 20s to his mid 30s the physical impairment (and in particular the capacity to have and maintain an erection) may be of less importance than some non-physiological factors.

Our results suggest the need for more in-depth research on the non-biological factors that may reduce sexual activity with age and may act mainly on the female component of the couple. For example, it will be interesting in further analyses to specifically take into account the impact of the number of children. Parity increases during the life course and it is expected to be influential on female sexuality (James 1981; Brewis and Meyer 2004).

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